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(54) IMPROVEMENTS IN MINE HOISTS

(71) We, ALLMÄNNA SVENSKA ELEKTRISKA AKTIEBOLAGET, a Swedish Company, of Västeras, Sweden, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In mines in which haulage is required from two or more different levels, it is customary to employ hoists which have two skips. These skips are suspended on individual cables each wound in opposite directions onto its own winding drum on a common winder, so that when one skip is at the loading station the other skip is simultaneously at the unloading station. For this to occur, i.e. to adjust the levels of the skips relative to each other, it is necessary for at least one of the winding drums to be releasable from a common driving means, usually a shaft connected to a common driving motor.

In known mine hoist constructions this connection is in the form of a controllable clutch, for example a dog clutch. These types of clutches, however, are not entirely satisfactory. When an alternation is to be carried out, the drums must be stationary during the coupling. Furthermore, an accurate indication of the angular position between the winding drums is necessary and the drums must be stopped in an exact relative position in order to allow re-engagement of the clutch elements after a separation. Since the skips balance each other it is not necessary for the brakes of the individual drums to be able to hold the torque generated by the wire tension on that drum in order that the hoist shall operate reliably. If the drums are released from each other when the skips are loaded, there is a certain risk that the holding torque of the brakes may be insufficient with the result that accurate adjustment cannot be obtained and the reconnection is made more difficult, or the skip cannot be held and falls down to its lowest position, possibly resulting in considerable damage.

In excavators there are sometimes two winding drums on a common driving shaft. In one type, one of the winding drums is fixed to the shaft and the other is rotatable and axially displaceable on the shaft. The rotatable drum can be displaced along the shaft to make contact with a conical friction surface on the other winding drum or on a stationary disc, and in this way can be connected to either of these. Both drums may be rotatable and axially displaceable on the shaft between stationary braking discs and a common driving disc secured to the shaft. During the displacement the winding drum can rotate freely on the shaft.

The winding drum of a large mine hoist may weigh 25—100 tons and the cables and skips 10—50 tons. These weights alone and the torque generated by the cables and skips, even during the switching mean that the construction principles known from excavators, having axially displaceable winding drums, cannot be used for mine hoists or provide any indication of how the problem should be solved in mine hoists.

According to the present invention, a mine hoist having two skips suspended by cables which are wound in opposite directions onto individual winding drums, which drums are axially fixed and arranged on a common driving shaft, at least one of the drums being rotatable about the shaft and connectible to the shaft by detachable connection means which enables adjustment of the position of the winding drums in relation to each other and locking of the winding drums at the desired angle to each other, is characterised in that said connection means comprises a friction clutch which is engaged by spring force and disengaged by at least one operating cylinder actuable by a pressure medium.

The connection means is most advantageously designed as a disc clutch having at least one, and preferably two friction discs joined to a winding drum and at least one

hub firmly secured to the common shaft of the winding drums, said hub supporting clutch units which straddle said friction disc, said units having pads of frictional material on opposite sides of the disc, one adjacent each opposite side of the disc and axially movable into frictional engagement with said opposite sides of the disc, spring means being provided normally to force said friction pads into frictional engagement with said disc and a fluid pressure operated piston and cylinder means being provided to move said friction pads against said spring means and away from said clutch disc. The winding drum friction disc or discs has or have limited axial and radial movement. When two interconnected discs are present in the winding drum, the hub supports at least one clutch disc which projects between the interconnected discs so that the number of friction surfaces is doubled. The clutch discs of the drum are annular whereas the clutch discs joined to the hub may consist of segments having approximately the same size in circumference as the friction pads on the clutch units.

In a mine hoist according to the invention the switchover from one loading level to another is facilitated. The clutch can be operated with the drums in an arbitrary angular position. Thus one skip is put into its correct position at the loading or unloading level and the clutch is disengaged. The drum of the other skip is then rotated until the other skip has reached its desired position at a different level. The clutch is then re-engaged and the operation of the hoist can start again immediately. The risk that the winding drums after being released from each other will not be able to be connected together again because a skip cannot be stopped is completely eliminated. The clutch can be more easily and reliably remotely-controlled, since the clutch means does not require the same degree of accuracy in size and alignment between the drums. Furthermore, the separate members forming the clutch have simpler geometric shapes or are standard, easily-obtainable units. All this contributes to providing a simple and cheap hoist, the maintenance of which is very easy to carry out.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings in which

Figure 1 is a schematic side view of a hoist with driving motor and intermediate gear,

Figure 2 is a view on a larger scale of the portion shown in section in Figure 1, and

Figure 3 is an end view of part of the clutch of Figures 1 and 2.

In the drawings, the numeral 1 designates a driving motor, 2 designates a gear, and 3 and 4 designate two winding drums which are arranged on a common shaft 5 supported by three bearings 6. The winding drums are provided with outer braking discs 7 and 8 and with braking units 9 and 10 which, during normal operation of the hoist, are operated simultaneously for engagement and disengagement with the discs. The drum 4 is joined to the shaft 5 while the drum 3 is rotatably mounted on the shaft 5 by means of a disc 11, a hum 12 and bushings 13 and 14 in the hub 12 and on the shaft 5, respectively.

The drum 3 is thus rotatably arranged in relation to the drum 4.

In the winding drum 3 are two annular clutch discs 15 which have limited axial and radial movement relative to the drum itself, since they are supported on a number of rubber bushings 16 on pegs 17 mounted in annular plates 18 and 19 joined to the drum 3. The axial movement is obtained by sliding on the bushings 16 while the radial movement is obtained due to resilience in the elastic material of the bushings. The radially elastic attachment prevents radial loads of a dangerous magnitude being transferred between the drum 3 and shaft 5 when play exists between the bushings 13 and 14. A hub 20 joined to a disc 21 is connected to the shaft 5 either by shrinking on or by means of a key 35. The disc 21 supports clutch units 22 and a number of segment-shaped clutch discs 23 provided with friction linings and which project in between the clutch discs 15. A spacer 24 having the same thickness as the disc 21 is provided to ensure that the units 22 are symmetrical in relation to the clutch discs 23. The clutch units 22, the spacers 24 and the friction discs 23 are fixed to the disc 21 with bolts 25. The clutch units 22 are of a type in which friction pads are pressed against a clutch by spring force and separated therefrom by an hydraulic cylinder. Standard units developed for clutch brakes can be used as the clutch units, which contributes to reducing the costs of the clutch. A number of units 22 dependent on the magnitude of the torque are arranged along the periphery of the disc 21. Pressure medium for disengaging the friction pads of the clutch units 22 is supplied through a conduit 26, a rotating hydraulic connection 27, channels 28 and 29 in the shaft 5, a conduit 30, distributing pieces 31 and conduits 32 and 33.

The clutch operates in the following way: At normal operation the pressure in the operating conduits is equal to atmospheric pressure and the friction pads of the clutch units are pressed by compression springs against the clutch discs in the drum 3 and these against the intermediate friction discs 23. The absence of over-pressure in the operating conduit for most of the operating

time means that the rotating hydraulic sealing may be of simple design and, in spite of this, have a very long life. Before the switchover the skip which is suspended by the winding drum 3 is moved to the unloading station, after which pressure medium is supplied to the clutch units 22 so that their friction pads are disengaged and the drum 3 is released from the shaft 5. The braking units 10 of the winding drum 4 are then disengaged while the braking units 9 of the winding drum 3 remain in position. By starting the driving motor in one or the other direction the skip suspended by the winding drum 4 can be raised or lowered to the desired stopping level, after which the brake units 10 and the clutch in the winding drum 3 are again connected. Haulage can now take place from this new stopping level. The hoist is suitably provided with interlock devices which prevent the brake units 9 and the connection in the drum 3 from being released simultaneously. Furthermore, the hoist is provided with safety means which automatically connect the clutch if one of the winding drums should move an impermissible amount during the switchover. The clutch thus serves as an extra safety brake for both the drums during the switchover.

WHAT WE CLAIM IS:—

1. A mine hoist having two skips suspended by cables which are wound in opposite directions onto individual winding drums which drums are axially fixed and arranged on a common driving shaft, at least one of the drums being rotatable about the shaft and connectible to the shaft by detachable connection means which enables adjustment of the position of the winding drums in relation to each other and locking of the winding drums at the desired angle to each other, characterised in that said connection means comprises a friction clutch which is engaged by spring force and disengaged by at least one operating cylinder actuable by a pressure medium.

2. A mine hoist according to claim 1, in which the clutch is a disc clutch having at least one friction disc joined to a winding drum and at least the hub firmly secured to the common shaft of the winding drums, said hub supporting clutch units which, straddle said friction disc, said units having pads of friction material on opposite sides of the disc, one adjacent each opposite side of the disc and axially movable into frictional engagement with said opposite sides of the disc, spring means being provided normally to force said friction pads into frictional engagement with said disc and a fluid pressure operated piston and cylinder means being provided to move said friction pads against the action of said spring means and away from said clutch disc.

3. A mine hoist according to claim 2, in which said friction disc is resiliently suspended so that limited movement thereof is obtained in relation to the drum.

4. A mine hoist according to claim 2, in which the disc clutch comprises at least two interconnected discs having limited axial and radial movement relative to the winding drum, in which the hub supports at least one clutch disc provided with friction linings which projects between said interconnected discs, said clutch units being arranged to straddle the stack of discs.

5. A mine hoist according to claim 4, in which the disc supported by the hub supports substantially segment-shaped clutch discs which project between said interconnected discs.

6. A mine hoist constructed and arranged substantially as herein described with reference to the accompanying drawings.

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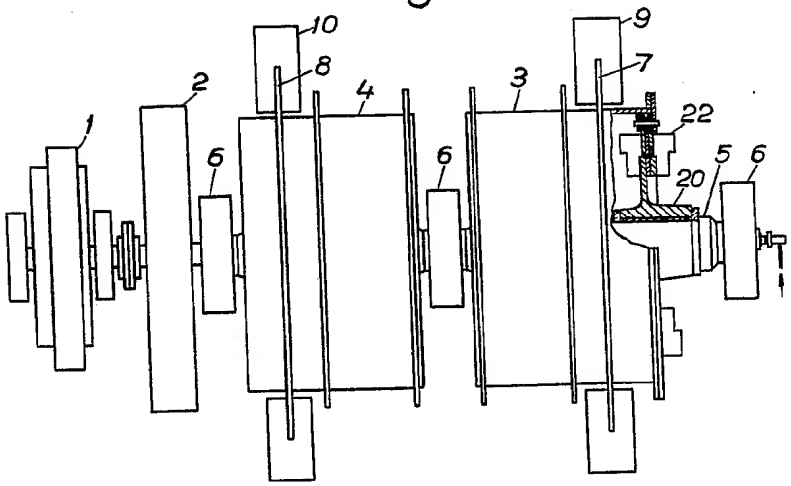
1265556 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1



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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

Fig. 2

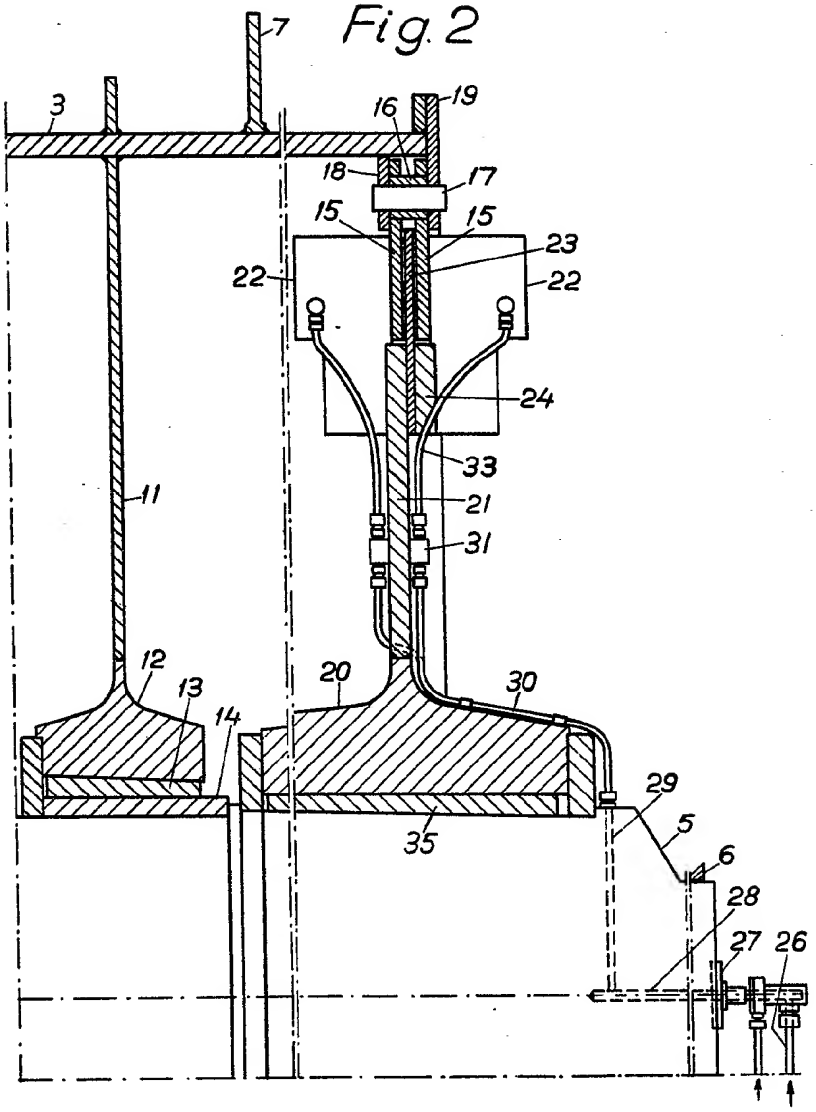

Fig.3